

**Before the  
Federal Communications Commission  
Washington, D.C. 20554**

In the matter of	)	
	)	
Carrier Current Systems, including Broadband over	)	ET Docket No. 03-104
Power Line Systems	)	
	)	ET Docket No. 04-37
Amendment of Part 15 regarding new requirements and	)	
measurement guidelines for Access Broadband over	)	
Power Line Systems	)	
	)	
	)	
	)	
	)	
	)	

---

**COMMENTS ON NOTICE OF PROPOSED RULE MAKING**

**Introduction**

These comments concern the FCC proposal concerning Broadband over Power Line (BPL), under Part 15 of the FCC Rules and Regulations. While I strongly support the concept of encouraging broadband Internet service across the country, I have very strong concerns about the impact on licensed radio users and the general public. My main interest in this proceeding is the adverse effect BPL is going to have on the Amateur Radio Service and other licensed radio users. I am also concerned that the public will experience interruption of BPL service due to the incompatibility of BPL systems and licensed radio transmitters.

**Harmful Interference**

BPL using frequencies below 50 MHz will result in interference to licensed users of the radio spectrum. The fundamental problem with BPL is that it transmits radio frequency signals using unshielded power lines that extend for distances that are much longer than the wavelength of the frequencies used. The well-understood theories associated with radio frequency signals, antennas and transmission lines predict that harmful interference will occur.

Recently, field tests of BPL technologies have confirmed that harmful interference does occur in practical installations. For example, the American Radio Relay League has documented interference to radio stations in the Amateur Radio Service<sup>1</sup>. The study performed by the National Telecommunications and Information Administration (NTIA) also confirms that BPL causes harmful interference to high frequency communications.<sup>2</sup> The interference experienced by amateur radio operator Gary Pearce (KN4AQ) at the Progress Energy BPL trial in Raleigh, NC has been documented and widely reported.<sup>3</sup> While BPL proponents have claimed that there have been no complaints of harmful interference, this is clearly incorrect.

The FCC has clearly stated that under Part 15 rules, operators of Access BPL systems will be responsible for eliminating any harmful interference that may occur. This is an important principle that must be emphasized in the implementation of rule changes concerning BPL. The Amateur Radio Service has a broad set of frequency allocations that will be affected by BPL. These allocations extend from 1.8 MHz to 29.7 MHz, in 10 separate frequency bands. This service has several other attributes that dramatically increases the probability of harmful interference from BPL. Amateur radio operators often communicate using very low-level signals, often just above the noise floor of the receiving system (typically less than 1 microvolt at the receiver input). Radio wave propagation at high frequencies varies with the time of day, time of year and solar activity. Due to the dramatic variation in signal propagation, amateur radio operators adjust their frequency up and down the allocated spectrum, choosing the best frequency band for existing propagation conditions to maintain communications. Mobile operation in vehicles and portable operation (operating from a temporary location) are both common, resulting in amateur radio stations operating from virtually anywhere. In summary, amateur radio stations operate on a wide range of frequencies, over a wide geographic area with a wide range of signal levels, which increases the probability of

---

<sup>1</sup> ARRL BPL Web page, <http://www.arrl.org/bpl>

<sup>2</sup> "Potential Interference From Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7 – 80 MHz", Phase 1 Study, NTIA Report 04-413

<sup>3</sup> Gary Pearce, KN4AQ, "BPL Primer: How Do I Know What I'm Hearing?", *CQ Amateur Radio*, May 2004, <http://www.cq-vhf.com/BPLCQMay.pdf>.

harmful interference from broadband emission sources. (Compare this to some other radio services where the frequency of operation is fixed and at a known location or geographic area.)

Most or all of the proposed BPL systems use complex modulation (such as Direct Sequence Spread Spectrum and Orthogonal Frequency Division Multiplexing) that creates broadband signals covering a wide frequency band. For example, the Amperion<sup>4</sup> system used by Progress Energy generated a series of closely spaced carriers about one kHz apart, 2.5 MHz to 3.5 MHz in width.<sup>5</sup> This type of signal can cause harmful interference across a large segment of the available frequency spectrum. If BPL is widely deployed, the radiated emissions from the power lines will stretch for miles and will cover a large geographical area. The characteristics of the Amateur Radio Service and BPL will interact to create widespread and frequent incidents of harmful interference.

### **Emission Limits**

The Commission has proposed that the existing Part 15 emission limits for carrier current systems be maintained for BPL systems. Given the high probability of harmful interference, any increase in emission limits would be counterproductive.

### **Avoidance and Mitigation of Interference**

If BPL is widely deployed, there will be harmful interference, so the challenge for the Commission and the BPL industry is to create effective methods for avoiding and resolving interference problems. The Commission is proposing that Access BPL devices be required to employ adaptive interference mitigation techniques. This is attractive in principle but will only be partially effective, particularly for spectrum users that use a wide range of frequencies and that must change operating frequency due to changing communication needs and conditions. Mobile and portable radio operators change locations and will encounter harmful interference at different locations.

---

<sup>4</sup> <http://www.amperion.com>

<sup>5</sup> Gary Pearce, KN4AQ, "BPL Primer: How Do I Know What I'm Hearing?", *CQ Amateur Radio*, May 2004, <http://www.cq-vhf.com/BPLCQMay.pdf>.

Since BPL systems may use different frequencies at different specific locations, understanding and predicting when harmful interference will occur is very difficult. It is *not* the case that a radio operator would experience interference on just one frequency of interest, notify the BPL provider and have the BPL provider reduce the emissions of that frequency, thereby eliminating harmful interference. The situation is almost always much more complex than this due to the characteristics of amateur radio operation previously mentioned.

The Commission should adopt rules that will aid the avoidance of harmful interference and the quick identification and resolution of harmful interference, including:

- Require the suppression of frequencies that are most likely to cause harmful interference. These frequencies should include the frequency allocation for the entire Amateur Radio Service and other frequencies identified by the NTIA report.<sup>6</sup>
- Require the creation and maintenance of a frequency database by all BPL providers. This database must include detailed descriptions of the BPL radio frequency emissions, so that signals can be quickly identified and the offending BPL provider notified.
- Require notification of licensed radio users in the vicinity of a BPL deployment, by the BPL provider, before the system is activated. This notification would include the list of frequencies used in the system and a detailed description of modulation type. Some form of electronic mail system could be used to notify interested radio licensees (who would register for this notification). This system could have the ability to indicate the radio licensee's specific geographic location so that they would receive notices of BPL deployments in that area.
- Require a quick response by the BPL provider to any harmful interference complaint, with substantial fines imposed by failing to resolve the complaint quickly.
- Require a signal point of control of a BPL system, with the ability to remotely adjust the frequencies of operation and disable portions of the BPL system to resolve interference problems.

---

<sup>6</sup> "Potential Interference From Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7 – 80 MHz", Phase 1 Study, NTIA Report 04-413

## **Effect on Consumers**

I am also concerned about how consumers of BPL services and the public in general will be effected by BPL deployment. Operating under Part 15, a BPL provider must tolerate signals from a licensed radio transmitter that are coupled into the BPL system. These signals can be quite large and may disrupt the operation of the BPL system. Also under Part 15, the BPL provider may be forced to shut down all or part of the BPL system in response to an incident of harmful interference. In both of these cases, consumers would have their BPL service interrupted due to the operation of licensed radio transmitters. One potential outcome is that the consumer blames the problem on the licensed radio user, which is inconsistent with the principles in Part 15. To minimize these problems and to forewarn consumers, the Commission should require that a written notice be delivered to the purchaser of the BPL service that clearly communicates the principles of harmful interference as outlined by Part 15. That is, the BPL system must not interfere and must tolerate interference from licensed radio users.

## **Measurement of BPL Systems**

There are a number of challenges present in the measurement of BPL Systems. Unlike most devices covered under Part 15, BPL represents a physically large system that can extend for miles. Thus, verification of radiated emissions on a RF test site is not feasible. Part 15 requirements need to be modified to accurately measure the radiated emissions of the deployed BPL system and ensure that they meet Part 15 emission levels.

- Measurements to verify compliance with emission levels should be required over the entire BPL system when deployed. Measurements of three "representative" locations are totally inadequate given the high complexity and variability in power line installations. The entire system must be active during the measurement audit so that any aggregated emissions are measured.
- An annual audit should be required to verify that the radiated emissions do not degrade over time. Emission measurements need to be maintained and publicly available so that emissions can be tracked over time.

- The NTIA study shows that higher emission levels occur when the measuring antenna is at greater height. For high frequency radio users, antenna height often exceeds the power line height. It is critical that compliance measurements use antenna heights of at least 10 meters, with an even higher antenna height desirable.

### **Summary**

It has been demonstrated that harmful interference to licensed radio users does occur when BPL is deployed. So far, the BPL trials in the US are relatively small. As deployment increases, we can only expect that the harmful interference will also increase. The FCC must take strong and technically sound action to minimize the harmful effects of this interference.

Dated this 29<sup>th</sup> day of April, 2004

Robert A. Witte  
Amateur Radio K0NR  
Electrical Engineer

21060 Capella Drive  
Monument, CO 80132